

GRADE 9 SCIENCE CURRICULUM SPECIFICATIONS

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GRADE 9 SCIENCE CURRICULUM SPECIFICATIONS

The Grade 9 Science Curriculum Specifications were prepared in July, 1981, under the direction of the Curriculum Branch of Alberta Education, by the Grade 9 Science Committee. The committee consisted of classroom teachers and Alberta Education personnel. Alberta Education acknowledges with appreciation the contributions of the members of the Grade 9 Science Committee.

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Three considerations were identified by the committee as major criteria underlying the curriculum specifications for Grade 9 Science Achievement Test.

1. Curriculum specifications are to be based wholly on the *Program of Studies for the Junior High Schools, 1978* (amended 1981).
2. The four major components or divisions of Grade 9 Science are to be included in the specifications. These divisions are:

Process Skills
Psychomotor Skills
Attitudes
Subject Matter

3. The major components or divisions are weighted and given priorities in a manner that reflects both classroom and program emphases.

WEIGHTING FACTORS

Percentage

- refers to the relative emphasis that a particular program component or division will receive.

Priority

- refers to the relative importance of a particular program concept, sub-concept or objective.

A
high priority

B

C
low priority

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Table 1 outlines the percentage of classroom time recommended for each of the four major divisions of the science curriculum. Table 2 presents the same percentages as they are subdivided for each of the major divisions. Table 3 outlines detailed curriculum specifications.

Table 1

Grade 9 Science - Curriculum Major Divisions

MAJOR COMPONENTS	EMPHASIS IN PERCENT
PROCESS SKILLS	30
PSYCHOMOTOR SKILLS	10
ATTITUDES	10
SUBJECT MATTER	50
TOTAL	100

REVISION PROCESS

The interim edition of these curriculum specifications was distributed in the fall of 1981 with reactions to be returned to the Student Evaluation Branch by December 31, 1981. These reactions were then collated and submitted to the Curriculum Branch for revision of the specifications. The revision committee met in late January and made such changes as were considered necessary.

Table 2

Grade 9 Science - Curriculum Subdivisions

SUBDIVISIONS	EMPHASES IN PERCENT
PROCESS SKILLS	30
Observing	
Classifying	
Quantifying	
Communicating	
Inferring	
Predicting	
Formulating hypotheses	
Defining terms	
Controlling variables	
Interpreting data and results	
Formulating models	
Experimenting	
Processing of data	
Identifying problems	
Seeking further evidence	
Applying discovered knowledge	
PSYCHOMOTOR SKILLS	10
Utilization of laboratory equipment and materials	

ATTITUDES

Curiosity	10 (equal emphasis)
Intellectual honesty	
Open-mindedness	
Belief in cause-effect relationships	
Suspended judgement	
Respect for accuracy and precision	
Skepticism	

Matter is composed of atoms and molecules.		7	
1. Theories and/or models have been developed to assist in understanding atoms.	2		
2. A relationship exists between atoms and and molecules.	2		
3. A relationship exists among elements, compounds and mixtures.	1		
4. There is a difference between physical and chemical changes.	2		
TOTAL			100

Table 3

Grade 9 Science Curriculum Subdivisions

PRIORITY	MAJOR DIVISIONS AND SUBDIVISIONS		EMPHASES IN PERCENT	TAXONOMIC LEVEL		
				KNOWLEDGE	APPLICATION & INTERPRETATION	HIGHER MENTAL PROCESSES
PROCESS SKILLS (30%)				NO ASSIGNMENT TO THE PROCESS SKILLS TO THE VARIOUS TAXONOMIC LEVELS WERE MADE SINCE THE PROCESS SKILLS WOULD VERY LIKELY BE INCORPORATED WITH SUBJECT MATTER.		
B	Observing	1. Using all the senses.				
C	Classifying	1. Grouping related objects or ideas.				
C	Quantifying	1. Using numbers and measurements.				
B	Communicating	1. Discussing.				
		2. Tabulating.				
		3. Graphing etc.				
A	Inferring					
A	Predicting					

PRIORITY	MAJOR DIVISIONS AND SUBDIVISIONS		EMPHASES IN PERCENT	TAXONOMIC LEVEL		
				KNOWLEDGE	APPLICATION & INTERPRETATION	HIGHER MENTAL PROCESSES
A	Processing of data	1. Organizing.				
		2. Representing graphically.				
		3. Treating mathematically.				
A	Identifying problems					
B	Seeking further evidence					
B	Applying discovered knowledge	- Also considered under taxonomic structure.				

PRIORITY	MAJOR DIVISIONS AND SUBDIVISIONS		EMPHASES IN PERCENT	TAXONOMIC LEVEL		
				KNOWLEDGE	APPLICATION & INTERPRETATION	HIGHER MENTAL PROCESSES
B	Formulating hypotheses					
A	Defining terms					
A	Controlling variables					
A	Interpreting data and results					
B	Formulating model	1. Verbal.				
		2. Pictorial.				
		3. Concrete.				
A	Experimenting	1. Planning and designing an investigation.				

PRIORITY	MAJOR DIVISIONS AND SUBDIVISIONS		EMPHASES IN PERCENT	TAXONOMIC LEVEL			
				KNOWLEDGE	APPLICATION & INTERPRETATION	HIGHER MENTAL PROCESSES	
PSYCHOMOTOR SKILLS (10%)							
	Utilization of laboratory equipment and materials	1. Accuracy					
		2. Safety					
		3. Calibration					
		Statements 1, 2, 3 above are intended as clarification regarding the nature of psychomotor skills being developed at this level of the science program is required. The skills are to be developed with equal emphasis.					
ATTITUDES (10%)							
	Belief in cause-effect relationships	Each of the attitude subdivisions is to receive equal emphasis.					
	Intellectual honesty						
	Curiosity and interest						

PRIORITY				MAJOR DIVISIONS AND SUBDIVISIONS	EMPHASES IN PERCENT	TAXONOMIC LEVEL		
Respect for accuracy and precision	Open-mindedness	Suspended judgment	Skepticism of biased statements			KNOWLEDGE	APPLICATION & INTERPRETATION	HIGHER MENTAL PROCESSES

PRIORITY	MAJOR DIVISIONS AND SUBDIVISIONS		EMPHASES IN PERCENT	TAXONOMIC LEVEL		
				KNOWLEDGE	APPLICATION & INTERPRETATION	HIGHER MENTAL PROCESSES
SUBJECT MATTER (50%)						
A	Matter occupies space and has mass	1. Fundamental to the process of science is the establishment of standards for making measurements. (a) The development of standard units and systems of measurement has taken place slowly.	3	B	A	C
A		(b) Good measurement techniques are necessary in order to obtain meaningful data.				
C		(c) All measurements are approximate.				
A		(d) Relationships existing among measurement data are often more clearly defined, and understanding is clarified, by graphing techniques.	10	B	A	C
A		2. Matter can be measured determining its linear dimensions, surface area and volume. (a) Length, surface area and volume of regular-shaped solids can be directly measured.				
B		(b) Volume of irregular-shaped solids may be found indirectly by liquid displacement.				
		3. Matter can be measured in terms of its mass and weight. - Mass and weight are two different measurements of matter.				

PRIORITY	MAJOR DIVISIONS AND SUBDIVISIONS		EMPHASES IN PERCENT	TAXONOMIC LEVEL						
				KNOWLEDGE	APPLICATION & INTERPRETATION	HIGHER MENTAL PROCESSES				
A		4. Density is a characteristic property of any given sample of matter and therefore is useful for identification purposes. (a) Molecular arrangement influences density.	3		B	A	B			
A		(b) Differences in the density of materials account for floating and sinking bodies.								
B	The forms and behavior of matter can be explained by the Kinetic Molecular Theory	1. Matter is composed of tiny particles. (a) Tiny particles of matter are called molecules.	3	15	C	A	A			
A		(b) Molecules vary in size.								
A		(c) Spaces exist between the molecules of matter.	4		C	A	A			
A		2. Molecules are in a state of constant motion. (a) Brownian movement provides indirect evidence of molecular motion.								
A		(b) Molecular motion in solids may be vibrational about a fixed position.								
A		(c) Molecules in liquids may be able to slide or move over one another in random directions.								
A		(d) Molecules in gases may have considerable freedom of movement in random directions.								
B		(e) The greater the freedom and rate of movement of molecules of the same kind, the higher their energy content.								

PRIORITY	MAJOR DIVISIONS AND SUBDIVISIONS		EMPHASES IN PERCENT	TAXONOMIC LEVEL		
				KNOWLEDGE	APPLICATION & INTERPRETATION	HIGHER MENTAL PROCESSES
A	3. Molecular movement is the basis for diffusion.		4	C	A	B
	(a) Diffusion is slow in solids due to limited molecular motion and the closely packed, orderly arrangement of the molecules.					
A	(b) Diffusion takes place more readily in liquids and gases.					
A	(c) Rate of diffusion depends on the temperature of the substances.					
A	(d) Rate of diffusion depends on the size of the molecules involved.					
A	(e) Dissolving is a form of diffusion.					
A	(f) Solutions are formed when molecules of one substance spread out evenly throughout another substance. - No boundaries between components of a solution can be observed.		4	C	A	B
	4. Molecular motion results in evaporation.					
A	(a) Evaporation involves a change in state from a liquid to a gas.					
A	(b) Evaporation occurs as faster moving molecules near the surface escape.					
A	(c) Evaporation produces a cooling effect.					
A	(d) Different liquids evaporate at different rates.					

PRIORITY	MAJOR DIVISIONS AND SUBDIVISIONS		EMPHASES IN PERCENT	TAXONOMIC LEVEL		
				KNOWLEDGE	APPLICATION & INTERPRETATION	HIGHER MENTAL PROCESSES
A		(e) Rate of evaporation of a given liquid depends on: <ul style="list-style-type: none"> - temperature of the liquid - vapor content of the air above - movement of air across the liquid surface 				
		<ul style="list-style-type: none"> - surface area of the liquid that is in contact with the air. 				
B	Heat and temperature can be explained in terms of molecular motion	1. Heat and temperature are related. (a) Temperatures may be measured indirectly by utilizing the response of matter to changes in temperature: <ul style="list-style-type: none"> - an arbitrarily chosen standard is necessary in the construction of most temperature scales - several temperature scales have been devised (Celsius, Kelvin and others). 	7	C	A	B
A		(b) Heat is measured indirectly by the effects it produces: <ul style="list-style-type: none"> - heat is measured by observing temperature of changes of a known mass of water at a known initial temperature - heat is measured in joules. 				
A		(c) Different substances absorb or release different amounts of heat, even though they have similar masses and undergo similar temperature changes: <ul style="list-style-type: none"> - the heat capacity of water is greater than that of most other substances - substances having high heat capacities are good coolants 				

PRIORITY	MAJOR DIVISIONS AND SUBDIVISIONS		EMPHASES IN PERCENT	TAXONOMIC LEVEL		
				KNOWLEDGE	APPLICATION & INTERPRETATION	HIGHER MENTAL PROCESSES
A		(d) When a body at higher temperature is in contact with a body at a lower temperature, heat flows from the first to the second body: - heat is conserved in that heat lost by one body is gained by the other - heat may be transferred by conduction, convection or radiation.	3	B	A	B
B		2. Matter exists in different states. (a) Matter can exist in solid, liquid, or gas form: - each state is characterized by definite general properties.				
A		(b) The addition or removal of heat causes matter to change state.				
B		(c) As any given pure substance changes state, its properties change but its composition does not.				
A		(d) Temperature remains constant during a change of state.				
		3. A relationship exists between molecular motion and the volume occupied by matter.	3	C	A	B
A		(a) With few exceptions the volume of a solid increases as molecular vibrational motion increases.				
A		(b) With the exception of water at temperature below 4°C, liquids increase in volume as molecular motion increases.				

PRIORITY	MAJOR DIVISIONS AND SUBDIVISIONS			EMPHASES IN PERCENT	TAXONOMIC LEVEL		
					KNOWLEDGE	APPLICATION & INTERPRETATION	HIGHER MENTAL PROCESSES
A		(c) At constant pressure all gases expand uniformly as molecular motion increases.					
C	Energy enables work to be done and motion to be changed	1. Energy may be described as either kinetic or potential energy.	1	5	A	B	C
C		2. Energy is present in the universe in several forms: - electrical - chemical - mechanical - heat - light - nuclear - gravitational - magnetic.	1		A	B	C
A		3. One form of energy may be changed into another.	3		B	A	A
B	Matter is composed of atoms and molecules	1. Theories and/or models have been developed to assist in understanding atoms. (a) All matter is made up of atoms.	2	7	A	A	B
A		(b) The atomic model has an internal structure consisting of protons and neutrons forming a central core or nucleus, and an outer structure of electrons.					
B		(c) The various kinds of atoms are called elements.					

PRIORITY	MAJOR DIVISIONS AND SUBDIVISIONS		EMPHASES IN PERCENT	TAXONOMIC LEVEL		
				KNOWLEDGE	APPLICATION & INTERPRETATION	HIGHER MENTAL PROCESSES
A	2. A relationship exists between atoms and molecules: - atoms can exist individually or in combination with other atoms of the same or different elements, and therefore, are the building blocks of molecules.	2		B	A	C
B	3. A relationship exists among elements, compounds and mixtures.	1		B	A	C
B	4. There is a difference between physical and chemical changes. (a) Several examples of physical change are observable: - physical properties of matter are determined by inter-molecular distances and forces - a change in state represents one of the most common physical changes - changes in molecular motion and intermolecular distances and forces of attraction (adhesion, cohesion) also account for physical changes.	2		B	A	A
A	(b) Several examples of chemical change are observable: - molecular composition determines the chemical properties of matter - most chemical changes require a great deal more energy than do physical changes.					

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